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Schulz et al.

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[54] **FILAMENT-DRAWING ASSEMBLY FOR SPINNING MACHINE**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[2] **D01H 1/22**; D01H 5/82
[52] **U.S. Cl.** ..... **19/293**; 74/665 G
[58] **Field of Search** ..... 19/293–295; 64/28 R, 28 M; 57/36, 37, 102; 192/54; 74/337, 665 B, 665 E, 665 G, 665 N

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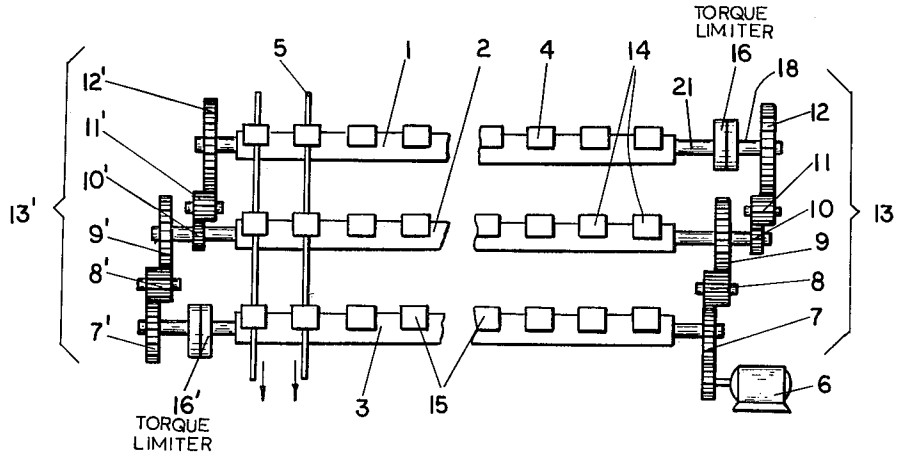
[57] **ABSTRACT**

An assembly of filament-drawing rollers, used for stretching rovings or fiber bundles in a spinning machine, is divided into a plurality of stages each including an elongate driven roller and a set of coacting counter-rollers, the driven rollers being interconnected at both ends by respective gear trains for rotation at predetermined relative speeds by a motor driving one of these gear trains. In order to prevent any overstressing of the mechanism if nonmatching gears are inadvertently inserted into the two gear trains, a torque limiter in the form of a shearing bolt or a friction clutch is interposed between at least one driven roller and an associated driving gear. Advantageously, the torque limiter is provided with a device generating an alarm signal upon relative rotation, due to overload, of its input and output shafts respectively joined to the driving gear and the driven roller.

12 Claims, 7 Drawing Figures



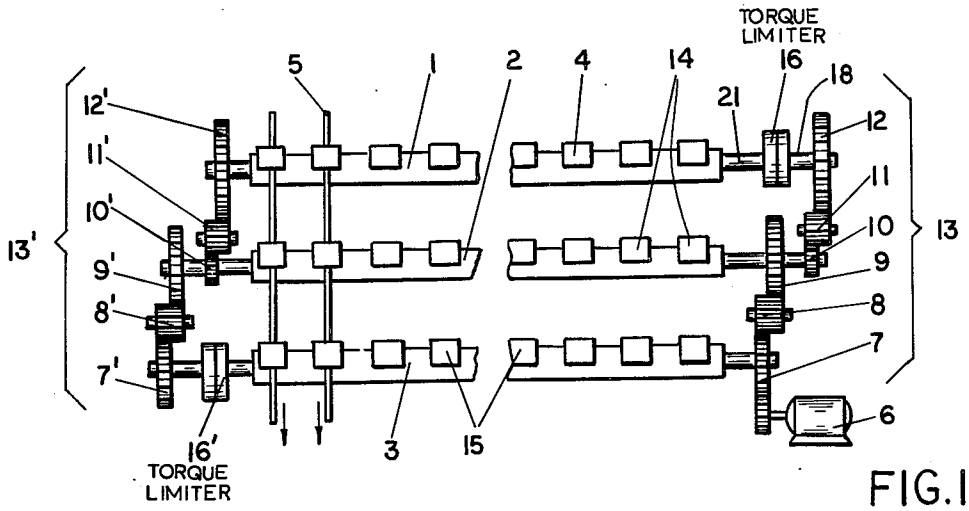


FIG.1

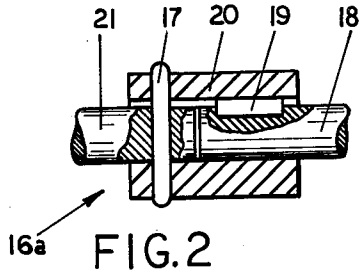


FIG.2

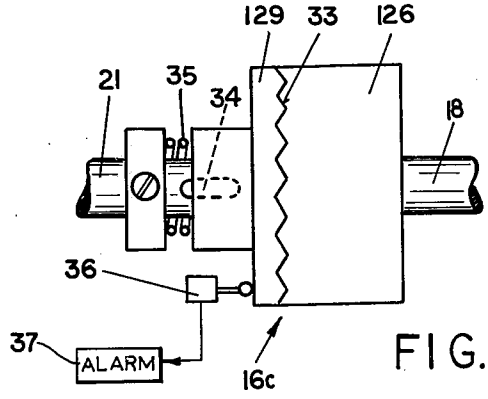


FIG.4

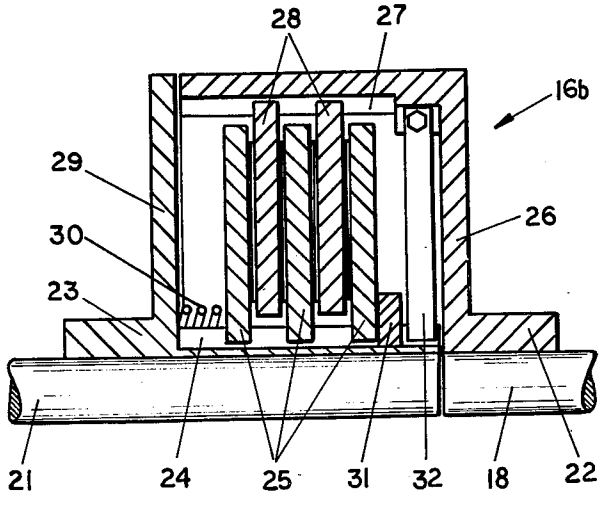


FIG.3

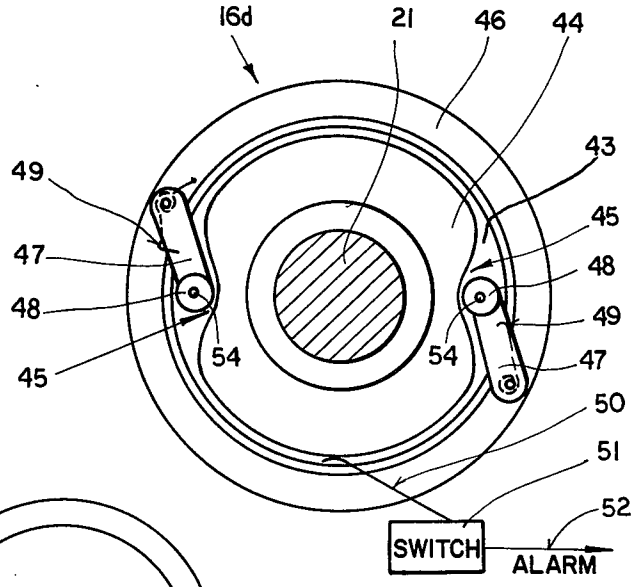
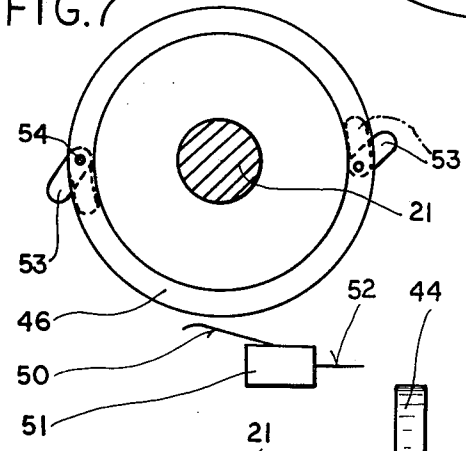


FIG. 5

FIG. 7



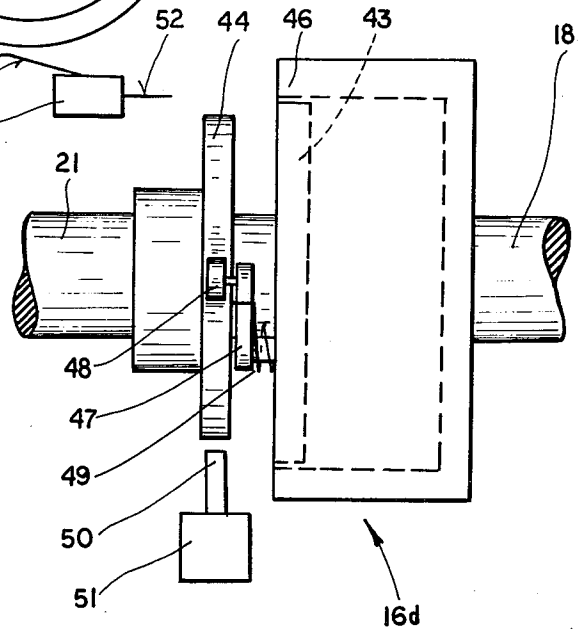


FIG. 6

FILAMENT-DRAWING ASSEMBLY FOR SPINNING MACHINE

FIELD OF THE INVENTION

Our present invention relates to a filament-drawing assembly, particularly for spinning machines, comprising a plurality of cascaded drawing stages each including an elongate driven roller and a set of coacting counterrollers.

BACKGROUND OF THE INVENTION

Assemblies of this type are used for the stretching of rovings or fiber bundles successively traversing the several stages. The driven rollers of these stages are simultaneously rotated at different speeds, progressively increasing from the first stage to the last, by drive means conventionally including a gear train having respective gears positively connected with one end of each driven roller. In order to minimize torsional stresses in these rollers, it has already been proposed to connect the other end of each driven roller with a respective gear of a second gear train which matches the first gear train whereby substantially identical torques are applied to opposite ends of each driven roller; such an arrangement is the subject matter of commonly owned U.S. patent application Ser. No. 832,701 filed by one of us, Günter Schulz, jointly with others on Sept. 12, 1977.

In order to change the relative speed of the several drawing stages in such an assembly, certain gears of the two gear trains will have to be replaced from time to time. If, through inadvertance, nonmatching gears are confrontingly inserted into these trains at such an occasion, the affected stage or stages could be severely overstressed with resulting damage to the mechanism.

OBJECTS OF THE INVENTION

The general object of our present invention, therefore, is to provide means in such a filament-drawing assembly for protecting its mechanism from damage due to overload, particularly to a torsional overstressing as discussed above, while facilitating continued operation until the defect can be remedied.

A more particular object is to provide means for generating an alarm signal in the event of such an overload without necessarily interrupting the operation of the assembly.

SUMMARY OF THE INVENTION

We realize these objects, in accordance with our present invention, by the interposition of torque-limiting means between one end of at least one driven roller and the corresponding gear drivingly connected thereto, the torque-limiting means having an input shaft rigid with the driving gear and an output shaft rigid with the driven roller which rotate in unison during normal operation but at different speeds in the event of an overload.

In a simple case the torque-limiting means may be constituted by a frangible link member, such as a transverse bolt or pin, interconnecting the two shafts. When an overload occurs, the link member is ruptured and the driven roller rotates at the speed imparted to it by the opposite gear train. After the defect becomes apparent, preferably through the intervention of an alarm device as described hereinafter, the operator will stop the machine and correct the defect giving rise to the overload; the broken link member will then have to be replaced. No such replacement is needed where the torque limiter is designed as a friction clutch.

The alarm device advantageously used in our system comprises a signal generator operatively coupled with one of the two shafts, preferably by being carried on the corresponding member of a friction clutch used as the torque limiter. As long as the shafts rotate at the same speed, the signal generator is inactive and no alarm is given. If, however, the shaft speeds differ, the generator is activated to emit a sound, trip a switch or otherwise attract the attention of the operator.

In a particularly advantageous arrangement, torque limiters according to our invention are inserted in different drawing stages on opposite sides of the roller assembly. This will provide additional protection in certain cases of overload not caused by mismatched gears.

BRIEF DESCRIPTION OF THE DRAWING

The above and other features of our invention will now be described in detail with reference to the accompanying drawing in which:

FIG. **1** is a somewhat diagrammatic view of a filament-drawing assembly according to our invention;

FIG. **2** is a side view, partly in section, of a torque limiter adapted to be used with the assembly of FIG. **1**;

FIG. **3** is an axial sectional view of the upper half of a friction clutch also usable as a torque limiter in the assembly of FIG. **1**;

FIG. **4** is a side-elevational view of a modified friction clutch according to our invention;

FIG. **5** is an end view of a further friction clutch, similar to the one shown in FIG. **3**, provided with an external signal generator;

FIG. **6** is a side-elevational view of the clutch and signal generator shown in FIG. **5**; and

FIG. **7** is an end view similar to FIG. **5**, showing a modification.

SPECIFIC DESCRIPTION

The filament-drawing assembly shown in FIG. **1**, associated with a nonillustrated spinning machine, comprises a cascade of drawing stages including respective elongate driven rollers **1**, **2** and **3** coacting with sets of counterrollers **4**, **14** and **15**. Fiber bundles **5** move successively through these three stages, as indicated by arrows, for progressive stretching before being delivered to the spinning machine.

The rollers **1–3** are simultaneously rotated, at progressively increasing speeds, by a motor **6** through a gear train **13** including a gear **7** positively connected with the right-hand end of the third-stage roller **3**, an intermediate pinion **8**, a gear **9** positively connected with the right-hand end of the second-stage roller **2**, two further pinions **10**, **11**, and a gear **12** drivingly connected with the right-hand end of the first-stage roller **1** via an input shaft **18**, a torque limiter **16** and an output shaft **21**. A matching gear train **13'** on the opposite side of the roller array comprises gears **7'–12'**; gear **7'** is drivingly connected with the left-hand end of roller **3** by way of a torque limiter **16'**, substantially identical with torque limiter **16**, whereas gears **9'** and **12'** are positively connected with the left-hand ends of rollers **2** and **1**, respectively.

It will be noted that the rollers **1–3** and the gear trains **13**, **13'** form two closed transmission loops, one of them

encompassing the rollers **1** and **2** while the other includes the rollers **2** and **3**. An accidental mismatch of the gears of either loop will set up torsional stresses therein which, in the absence of torque limiters **16** and **16'**, would have a destructive effect. Devices **16** and **16'** are so designed as to keep their respective input and output shafts rotating in unison during normal operation, i.e. when the torque transmitted by the input shaft lies within or only slightly above a predetermined range, but to decouple these shafts from each other when the driving torque approaches a critical limit.

If an overload should occur for reasons other than a mismatch of confronting gears, e.g. because of a jamming of the first drawing stage **1**, **4** by a misplaced object, the assembly will also be protected against damage since both torque limiters **16** and **16'** will then cut out.

In FIG. **2** we have shown a simple torque limiter **16***a*, adapted to be used for either of the devices **16**, **16'** in FIG. **1**, which comprises a sleeve **20** rotatably entrained by the input shaft **18** through a key **19**; sleeve **20** partly surrounds the output shaft **21** with which it is linked by a shearing bolt **17** traversing the latter. The shear strength of bolt **17** is so chosen that it is fractured in the event of an overload so that the shafts **18** and **21** are free to rotate relatively to each other. Upon removal of the overload-causing condition, the fragments of bolt **17** are removed and replaced by a new bolt again calibrated to break in the presence of an excessive torque.

FIG. **3** shows a torque limiter **16***b* which comprises a friction clutch with two members **26** and **29** having hubs **22** and **23** rigid with shafts **18** and **21**, respectively. Member **26** forms a cylindrical housing around two sets of interleaved annular disks **25** and **28** which are slidably guided by axially extending outer ribs **24** on member **29** and inner ribs **28** on member **26**, respectively. The stack of disks **25**, **28** is compressed between a coil spring **30** and an abutment ring **31**, the latter being fixedly secured to member **29**. Friction layers on the confronting disk faces insure their joint rotation within the range of normal torques. In the event of an overload, determined by their frictional coefficient and by the force of spring **30**, a relative slippage occurs between clutch members **26** and **29** so that shafts **18** and **21** are effectively decoupled.

A leaf spring **32** secured to the inner peripheral wall of clutch member **26** has a free end normally resting on one of the ribs **24** or extending into a space between two such ribs so as to be engaged by them for generating a rattling noise upon relative rotation of shafts **18** and **21**.

In FIG. **4** we have shown a torque limiter **16***c* comprising a similar friction clutch with members **126** and **129**, the former being fixedly secured to its shaft **18** whereas member **129** is only rotatably coupled with shaft **21** by a key **34** and is axially slidable, in a direction away from member **126**, against the force of a compression spring **35**.

The two clutch members **126** and **129** are provided with coacting camming formations in the shape of peripheral serrations or undulations **33** normally held in mating engagement by the pressure of spring **35**. When an overload causes these clutch members to slip, member **129** is cammed to the left and trips a malfunction-sensing switch **36** which actuates an alarm indicator **37**.

FIGS. **5** and **6** illustrate a torque limiter **16***d* which comprises a friction clutch similar to those shown in FIGS. **3** and **4**, with juxtaposed members **43** and **46** respectively carried on shafts **21** and **18**. A cam disk **44**, also rigid with shaft **21**, has two diametrically opposite peripheral recesses **45** normally engaged by cam-follower rollers **48** on a pair of swingable arms **47** which are fulcrumed on clutch member **43** by pivot pins **54** and are biased inwardly by springs **49**. The pressure of these springs should be sufficient to resist the centrifugal force acting upon the rollers **48** during rotation, yet this centrifugal force could also be balanced by a weighted outward extension of each arm **47** beyond its pivotal axis.

A feeler **50** of a sensing switch **51**, stationary alongside disk **44**, extends toward the periphery of that disk but is not engaged by the rollers **48** unless a relative rotation of shafts **18** and **21** forces these rollers out of their recesses **45**. In such a case the switch **51** is tripped and energizes an output lead **52** to actuate an alarm indicator such as the one shown at **37** in FIG. **4**.

The cam disk **44** could also be disposed inside the housing formed by clutch member **46**. In such a case, as illustrated in FIG. **7**, pivot pins **54** of cam-follower arms **47** (FIGS. **5** and **6**) may have extensions **53** which are normally retracted into the outline of member **46** (as indicated in dot-dash lines) but project radially outwardly, as shown in full lines, upon relative rotation of shafts **18** and **21** so as to trip the sensing switch **51**.

We claim:

1. A filament-drawing assembly comprising:

a plurality of cascaded drawing stages each including an elongate driven roller and a set of coacting counterrollers;

drive means for simultaneously rotating said driven rollers at different speeds, said drive means including a first gear train with respective gears drivingly connected to one end of each of said driven rollers and a second gear train with respective gears drivingly connected to the other end of each of said driven rollers, confronting gears of said first and second gear trains matching each other to apply substantially identical torques to the ends of each driven roller;

torque-limiting means interposed between an end of at least one of said driven rollers and the corresponding gear drivingly connected thereto, said torque-limiting means having an input shaft rigid with said corresponding gear and an output shaft rigid with said one of said driven rollers, said shafts rotating in unison during normal operation but at different speeds in the event of an overload; and

signal-generating means operatively coupled with said shafts for giving an alarm indication upon relative rotation thereof.

2. An assembly as defined in claim **1** wherein said torque-limiting means comprises a frangible link member interconnecting said shafts.

3. An assembly as defined in claim **1** wherein said torque-limiting means comprises a friction clutch.

4. An assembly as defined in claim **1** wherein said torque-limiting means comprises a first torque limiter interposed between said first gear train and an end of one driven roller, and a second torque limiter interposed between said second gear train and an end of another driven roller.

5. A filament-drawing assembly comprising:

a plurality of cascaded drawing stages each including an elongate driven roller and a set of coacting counterrollers;

drive means for simultaneously rotating said driven rollers at different speeds, said drive means includ-

ing a first gear train with respective gears drivingly connected to one end of each of said driven rollers and a second gear train with respective gears drivingly connected to the other end of each of said driven rollers, confronting gears of said first and second gear trains matching each other to apply substantially identical torques to the ends of each driven roller; and

torque-limiting means interposed between an end of at least one of said driven rollers and the corresponding gear drivingly connected thereto, said torque-limiting means having an input shaft rigid with said corresponding gear and an output shaft rigid with said one of said driven rollers, said shafts being interconnected by a frangible link member for rotating in unison during normal operation but at different speeds upon rupture of said link member in the event of an overload.

6. An assembly as defined in claim **5** wherein said link member comprises a shearing bolt on one of said shafts traversing an axial extension of the other of said shafts.

7. A filament-drawing assembly comprising:

a plurality of cascaded drawing stages each including an elongate driven roller and a set of coacting counterrollers;

drive means for simultaneously rotating said driven rollers at different speeds, said drive means including a first gear train with respective gears drivingly connected to one end of each of said driven rollers and a second gear train with respective gears drivingly connected to the other end of each of said driven rollers, confronting gears of said first and second gear trains matching each other to apply substantially identical torques to the ends of each driven roller; and

a friction clutch interposed between an end of at least one of said driven rollers and the corresponding gear drivingly connected thereto, said friction clutch having an input shaft rigid with said corresponding gear and an output shaft rigid with said one of said driven rollers, said shafts rotating in unison during normal operation but at different speeds upon slippage of the friction clutch in the event of an overload.

8. An assembly as defined in claim **7** wherein said friction clutch comprises two juxtaposed members respectively carried on said shafts for joint rotation therewith, further comprising signal-generating means operatively coupled with at least one of said members for giving an alarm indication upon a relative displacement of said members due to overload.

9. An assembly as defined in claim **8** wherein said members are provided with concentric arrays of axially extending ribs and with respective sets of annular disks slidably guided on said ribs in interleaved relationship, said signal-generating means comprising a resilient blade on one of said members having a free end engageable with the ribs of the other of said members upon relative rotation thereof.

10. An assembly as defined in claim **8** wherein said members are provided with coacting camming formations tending to separate said members axially against a counteracting spring force upon relative rotation thereof, said signal-generating means comprising a sensor positioned for actuation by an axial shift of said one of said members.

11. An assembly as defined in claim **7**, further comprising a peripherally recessed cam disk on one of said shafts, a radially movable cam follower on the other of said shafts biased into engagement with said disk, and signal-generating means including a sensor positioned for actuation by said cam follower upon a radially outward movement thereof to give an alarm indication in the event of relative rotation of said shafts.

12. A filament-drawing assembly comprising:

a plurality of cascaded drawing stages each including an elongate driven roller and a set of coacting counterrollers;

drive means for simultaneously rotating said driven rollers at different speeds, said drive means including a first gear train with respective gears drivingly connected to one end of each of said driven rollers and a second gear train with respective gears drivingly connected to the other end of each of said driven rollers, confronting gears of said first and second gear trains matching each other to apply substantially identical torques to the ends of each driven roller;

torque-limiting means interposed between an end of at least one of said driven rollers and the corresponding gear drivingly connected thereto, said torque-limiting means having an input shaft rigid with said corresponding gear and an output shaft rigid with said one of said driven rollers, said shafts rotating in unison during normal operation but at different speeds in the event of an overload;

a peripherally recessed cam disk on one of said shafts;

a radially movable cam follower on the other of said shafts biased into engagement with said disk; and

signal-generating means including a sensor positioned for actuation by said cam follower upon a radially outward movement thereof to give an alarm indication in the event of relative rotation of said shafts.

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